COGNITION AND STUDENT LEARNING RESEARCH GRANTS

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REQUEST FOR APPLICATIONS NUMBER: NCER-04-01

INSTITUTE OF EDUCATION SCIENCES
http://www.ed.gov/programs/edresearch/applicant.html

LETTER OF INTENT RECEIPT DATE: November 20, 2003

APPLICATION RECEIPT DATE: January 8, 2004

THIS REQUEST FOR APPLICATIONS CONTAINS THE FOLLOWING INFORMATION:

1. REQUEST FOR APPLICATIONS

The Institute of Education Sciences (Institute) invites applications for research projects that will contribute to its research program on Cognition and Student Learning (Cognition). For this competition, the Institute will consider only applications that meet the requirements outlined below under the section on Requirements of the Proposed Research.

2. PURPOSE OF THE RESEARCH PROGRAM

The purpose of the Cognition research program is to improve student learning by bringing recent advances in cognitive science to bear on significant problems in education. The long-term outcome of this program is to develop approaches to instruction that are based on principles of learning and information processing gained from cognitive science and to provide evidence of their usefulness in education settings.

3. BACKGROUND

The most important outcome of education is student learning. Recent advances in understanding learning have come from cognitive science, cognitive psychology, and neuroscience research, but these advances have not been widely or systematically tapped in education. The Institute intends for the Cognition research program to establish a scientific foundation for education by building on these theoretical and empirical advances and applying them to education practice with the goal of improving student learning and academic achievement. The Institute is conducting this grant competition to establish a stream of research bridging basic cognitive science and education.

Cognitive science, including studies of attention, memory, decision-making, and higher order thinking skills, has shown explosive growth in the last 25 years. Basic research in cognitive science within disciplines such as psychology, linguistics, and neuroscience has generated new and important fundamental knowledge on how people learn. Cognitive scientists have identified a number of basic principles of learning that are supported by a solid research base (e.g., Carver & Klahr, 2001). For the most part, however, these research principles have not been incorporated into education practice, either at the level of instruction or through the creation of materials that support teaching and learning. Consider, for instance, research on the structure and organization of knowledge. Cognitive scientists have examined differences between experts and novices in a variety of domains and have discovered basic principles underlying how learners organize knowledge as a function of familiarity and expertise within a given domain. Understanding how novices acquire and organize new information would seem to be critical, for example, to sequencing the content of curricula. Typically, however, curricula reflect how knowledge in a field is organized by experts and do not reflect how knowledge is acquired by novices.

Traditionally cognitive scientists have conducted well-controlled experiments in laboratory settings. Teaching and learning in the classroom are complex cognitive (and social) activities. Cognitive processing in this type of setting may be markedly different from the laboratory. One goal of the Cognition research program is to better understand learning and cognitive processing as it occurs in the classroom – a cognitively rich environment in which multiple activities occur simultaneously – so that instructional approaches can be developed that maximize student learning.

Through the Cognition research program, the Institute will support research in the cognitive sciences that contributes to improving learning in education delivery settings and developing new approaches to instruction that take advantage of cutting-edge research on the science of learning. In the first two competitions of the Cognition research program, the Institute required investigators to conduct at least one component of the research project in an education delivery

setting and thereby begin to bridge the laboratory work central to basic cognitive science and the "in-field" research necessary to use that knowledge to transform how teaching and learning occur in education delivery settings. To continue that transformation, the Institute focuses the 2004 Cognition research competition on cognitive science research that will be conducted primarily in education delivery settings. The goal in this shift in emphasis is to enhance our understanding of the practical challenges of using the findings of cognitive science to transform the practice of teaching and learning.

4. REQUIREMENTS OF THE PROPOSED RESEARCH

For the 2004 Cognition research competition, applicants should submit *either* under Goal 1 or under Goal 2. Applicants should indicate in the abstract the goal under which they are applying. The purpose of Goal 1 is to understand thinking and learning as it occurs in complex education delivery settings. The purpose of Goal 2 is to develop and evaluate instructional practices or materials that are derived from general cognitive principles.

Applications under Goal 1. Applications are requested that are proposals to address basic or higher-order cognitive processes and directly link those processes to improving student learning and achievement. Applicants should propose theoretically driven hypotheses relevant to student learning of typical academic content (e.g., mathematics skills and knowledge that students are held accountable for learning by teachers or schools), and should propose to test these hypotheses in education delivery settings (e.g., classrooms, online or computer-based instruction, tutoring). For example, in any cognitive task there are many pieces of information that can draw one's attention. Good learners are able to attend selectively to relevant information and disregard irrelevant content. A classroom-based study might examine the conditions under which students' attention to relevant information is maximized within the context of group instruction during a science lesson.

Under Goal 1, applicants may include laboratory experiments as part of the proposed project, but the primary focus of the project must be to examine learning of typical academic content in education settings.

Typical awards under Goal 1 are $150,000 to $350,000 per year for up to 3 years. Substantially larger budgets will be considered if a compelling case can be made for such support. The size of the award depends on the scope of the project.

Applications under Goal 2. Under the second goal, applications are invited that are proposals to develop instructional practice or materials based on general principles of learning and information processing gained from cognitive science and test the effects of these new approaches within education delivery settings. One explanation for the limited use of instructional practices based on cognitive science is that education delivery settings are often quite different from the laboratory. For example, contrasted with laboratory settings, learning in everyday instructional settings typically involves content of greater complexity and scope, delivered over much longer periods of time, with much greater variability in delivery, and with far more distractions and competitors for student time and effort. Studies that manipulate thinking or information processing in controlled settings may not generate results that necessarily transfer in a straightforward way to improving thinking and learning in the classroom or other

education delivery settings. Consequently, in addition to developing strategies for improving learning in the laboratory, it is important to develop and adapt strategies specifically for classroom use. For example, the researcher might propose to collaborate with teachers to develop strategies in which principles of learning based on cognitive science are instantiated in an instructional approach. In the context of a design study, the researchers and teachers might go through multiple iterations of implementing and refining the instructional approach during the first phase of the project. Researchers might, then, examine empirically the effects of the instructional approach on student learning.

Under Goal 2, then, applications are invited that focus on developing novel instructional practices or materials based on principles of learning gained from cognitive science and on empirically examining the effects of these approaches on learning academic content in education delivery settings. Researchers should note that the Institute is interested in the development of strategies and materials that involve students learning educationally meaningful or relevant components or units of academic content, such as would be covered in a chapter or multiple chapters addressing a topic or learning goal in a textbook.

Typical awards under Goal 2 are $150,000 to $350,000 per year for up to 3 years. Substantially larger budgets will be considered if a compelling case can be made for such support. The size of the award depends on the scope of the project.

Requirements that apply to all Cognition research proposals.

(a) All applicants should explicitly describe how the proposed research would contribute to the solution of significant education problems in the U.S.

(b) The proposed research must be grounded in cognitive theory and supported by relevant prior empirical evidence, both of which must be well articulated.

(c) Research questions or hypotheses must be clearly specified. In the description of the design of the studies (e.g., experimental, quasi-experimental, correlational, descriptive), independent and dependent, or predictor and criterion, or descriptive and explanatory variables should be distinguished and methods for providing reliable measures of each variable should be detailed. It is essential that the research methods be appropriate to the specified research questions or hypotheses. For example, where causal connections are to be tested, studies incorporating experimental designs with randomized assignment generally provide the strongest tests of the hypotheses. Descriptions of the design and data analysis strategies must provide sufficient detail for reviewers to determine if the research questions are appropriately addressed. In addition, if the research is intended to test hypotheses, the design should make it possible, in principle, to obtain results that disconfirm the hypotheses. Any approach must incorporate a valid process that allows for generalizations beyond the study participants. For research including interventions conducted in education settings, methods and measures for tracking implementation of the intervention should also be described.

(d) Because all applicants must propose to conduct the majority of the research project in a classroom or other education setting, applicants must develop relationships with schools (or

other education delivery settings). Applicants are required to document the availability and cooperation of the schools or other education delivery settings that will be required to carry out the research proposed in the application via a letter of support from the education organization(s).

5. APPLICATIONS AVAILABLE

Application forms and instructions for the electronic submission of applications will be available for this program of research no later than December 9, 2003, from the following web site:

http://ies.constellagroup.com

6. MECHANISM OF SUPPORT

The Institute intends to award grants for periods up to 3 years pursuant to this request for applications. Please see specific details for each goal in the Requirements of the Proposed Research section of the announcement.

7. FUNDING AVAILABLE

The size of the award depends on the scope of the project. Please see specific details in the Requirements of the Proposed Research section of the announcement. Although the plans of the Institute include this program of research, awards pursuant to this request for applications are contingent upon the availability of funds and the receipt of a sufficient number of meritorious applications. The number of projects funded under a specific goal depends upon the number of high quality applications submitted to that goal. The Institute does not have plans to award a specific number of grants under each particular goal.

8. ELIGIBLE APPLICANTS

Applicants that have the ability and capacity to conduct scientifically valid research are eligible to apply. Eligible applicants include, but are not limited to, non-profit and for-profit organizations and public and private agencies and institutions, such as colleges and universities.

9. SPECIAL REQUIREMENTS

Research supported through this program must be relevant to U.S. schools. Recipients of awards are expected to publish or otherwise make publicly available the results of the work supported through this program.

Applicants should budget for one meeting each year in Washington, DC, with other grantees and Institute staff. At least one project representative should attend the two-day meeting.

If the applicant has a negotiated off-campus indirect cost rate with the U.S. Department of Health and Human Services or other cognizant federal agency, the applicant must apply that off-campus indirect rate, proportional to the activities (including implementation of an intervention, if one is proposed) that will be conducted off-campus under the applicant's proposal.

10. LETTER OF INTENT

A letter indicating a potential applicant's intent to submit an application is optional, but encouraged, for each application. The letter of intent must be submitted electronically by the

date listed at the beginning of this document, using the instructions provided at the following web site:

http://ies.constellagroup.com

The letter of intent should include a descriptive title, the goal which the application will address, and brief description of the research project (no longer than one page, single-spaced, using a 12 point font without compression or kerning); the name, institutional affiliation, address, telephone number and e-mail address of the principal investigator(s); and the name and institutional affiliation of any key collaborators. The letter of intent should indicate the duration of the proposed project and provide an estimated budget request by year, and a total budget request. Although the letter of intent is optional, is not binding, and does not enter into the review of subsequent applications, the information that it contains allows Institute staff to estimate the potential workload to plan the review.

11. SUBMITTING AN APPLICATION

Applications must be submitted **electronically by 8:00 p.m**. **Eastern time** on the application receipt date, using the ED standard forms and the instructions provided at the following web site:

http://ies.constellagroup.com

Application forms and instructions for the electronic submission of applications will be available for this program of research no later than **December 9, 2003**. Potential applicants should check this site for information about the electronic submission procedures that must be followed and the software that will be required.

The application form approved for this program is OMB Number 1890-0009.

12. CONTENTS AND PAGE LIMITS OF APPLICATION

All applications and proposals for Institute funding must be self-contained within specified page limitations. Internet Web site addresses (URLs) may not be used to provide information necessary to the review because reviewers are under no obligation to view the Internet sites.

Sections described below, and summarized in Table 1, represent the body of a proposal submitted to the Institute and should be organized in the order listed below. Sections *a* (ED 424) through *h* (Appendix A) are required parts of the proposal. Section *i* (Appendix B) is optional. All sections must be submitted electronically.

Observe the page number limitations given in Table 1.

Table 1

Section	Page Limit	Additional Information
a. Application for Federal Education Assistance (ED 424)	n/a	
b. Budget Information Non-Construction Programs (ED 524)	n/a	
c. Project Abstract	1	
d. Research Narrative	20	Figures, charts, tables, and diagrams may be included in Appendix A
e. Reference List	no limit	Complete citations, including titles and all authors
f. Curriculum Vita of Key Personnel	3	No more than 3 pages for each key person
g. Budget Narrative	no limit	
h. Appendix A	10	
i. Appendix B	15	

a. *Application for Federal Education Assistance (ED 424).* The form and instructions are available on the website.

b. *Budget Information Non-Construction Programs (ED 524).* The application must include a budget for each year of support requested and a cumulative budget for the full term of requested Institute support. Applicants must provide budget information for each project year using the ED 524 form (a link to the form is provided on the application website at http://ies.constellagroup.com). ED 524 form has three sections: A, B, and C. Instructions for Sections A and B are included on the form. Instructions for Section C are as follows. Section C must provide an itemized budget breakdown for each project year, for each budget category listed in Sections A and B. Section C may be submitted as an Excel spreadsheet with an itemized listing of project costs. For personnel, include a listing of percent effort for each project year, as well as the cost. Section C should also include a breakdown of the fees to consultants, a listing of each piece of equipment, itemization of supplies into separate categories, and itemization of travel requests (e.g. travel for data collection, conference travel, etc.) into separate categories. Any other expenses should be itemized by category and unit cost.

c. *Project abstract*. The abstract is limited to one page and must include: (1) The title of the project; (2) the RFA goal under which the applicant is applying; and brief descriptions of (3) the potential contribution the proposed project will make to the solution of an education problem; (4) the population(s) from which the participants of the study(ies) will be sampled (age groups, race/ethnicity, SES); (5) the proposed research method(s); and (6) the proposed intervention if one has been proposed.

d. *Research narrative*. Incorporating the requirements outlined under the section on Requirements of the Proposed Research, the *research narrative* provides the majority of

the information on which reviewers will evaluate the proposal and should include the following sections (1 through 4) in the order listed:

(1) Contribution of Project to Solving an Education Problem (suggested: 3-4 pages)
Identify the education problem that will be addressed by the study and describe the contribution the study will make to a solution to that problem.

(2) Research Plan (suggested: 12-15 pages)

i. Provide a compelling rationale addressing, where applicable, the theoretical foundation, relevant prior empirical evidence supporting the proposed project, and the practical importance of the proposed project.

   For projects in which an intervention is proposed, include a description of the intervention along with the conceptual rationale and empirical evidence supporting the intervention. (Applicants proposing an intervention may use Appendix B to include up to 10 pages of examples of curriculum material, computer screens, or further description of the intervention);

ii. Include clear, concise hypotheses or research questions;

iii. Present a clear description of, and a rationale for, the sample or study participants, including justification for exclusion and inclusion criteria and, where groups or conditions are involved, strategies for assigning participants to groups;

iv. Provide clear descriptions of, and rationales for, data collection procedures and measures to be used; and

v. Present a detailed data analysis plan that justifies and explains the selected analytic strategy, shows clearly how the measures and analyses relate to the hypotheses or research questions, and indicates how the results will be interpreted. Quantitative studies should, where sufficient information is available, include a power analysis to provide some assurance that the sample is of sufficient size.

(3) Personnel (suggested: 1-2 pages)
Include brief descriptions of the qualifications of key personnel (information on personnel should also be provided in their curriculum vitae).

(4) Resources (suggested: 1-2 pages)
Provide a description of the resources available to support the project at the applicant's institution and in the field settings in which the research will be conducted.

The research narrative is limited to the equivalent of 20 pages, where a "page" is 8.5 in. x 11 in., on one side only, with 1 inch margins at the top, bottom, and both sides. Single

space all text in the research narrative. To ensure that the text is easy for reviewers to read and that all applicants have the same amount of available space in which to describe their projects, applicants must adhere to the type size and format specifications for the entire research narrative including footnotes, or the application will be returned without review. See frequently asked questions available at http://ies.constellagroup.com on or before December 9, 2003.

Conform to the following four requirements:

(1) The height of the letters must not be smaller than 12 point;

(2) Type density, including characters and spaces, must be no more than 15 characters per inch (cpi). For proportional spacing, the average for any representative section of text must not exceed 15 cpi;

(3) No more than 6 lines of type within a vertical inch;

(4) Margins, in all directions, must be at least 1 inch.

Applicants should check the type size using a standard device for measuring type size, rather than relying on the font selected for a particular word processing/printer combination. Figures, charts, tables, and figure legends may be smaller in size but must be readily legible. The type size used must conform to all four requirements. Small type size makes it difficult for reviewers to read the application; consequently, the use of small type will be grounds for the Institute to return the application without peer review. Adherence to type size and line spacing requirements is also necessary so that no applicant will have an unfair advantage, by using small type, or providing more text in their applications. **Note, these requirements apply to the PDF file as submitted.** As a practical matter, applicants who use a 12 point Times New Roman without compressing, kerning, condensing or other alterations typically meet these requirements.

Use only black and white in graphs, diagrams, tables, and charts. The application must contain only material that reproduces well when photocopied in black and white.

The 20-page limit does *not* apply to the ED 424 form, the one-page abstract, the ED 524 form and narrative budget justification, the curriculum vitae, or reference list. Reviewers are able to conduct the highest quality review when applications are concise and easy to read, with pages numbered consecutively.

e. *Reference list*. Please include complete citations, including titles and all authors, for literature cited in the research narrative.

f. *Brief curriculum vita of key personnel*. Abbreviated curriculum vita should be provided for the principal investigator(s) and other key personnel. Each vitae is limited to 3 pages and should include information sufficient to demonstrate that personnel possess training

and expertise commensurate with their duties. The curriculum vita must adhere to the margin, format, and font size requirements described in the research narrative section.

g. *Budget justification*. The *budget justification* must provide sufficient detail to allow reviewers to judge whether reasonable costs have been attributed to the project. It must include the time commitments and brief descriptions of the responsibilities of key personnel. *The budget justification should correspond to the itemized breakdown of project costs that is provided in Section C.* For consultants, the narrative should include the number of days of anticipated consultation, the expected rate of compensation, travel, per diem, and other related costs. A justification for equipment purchase, supplies, travel and other related project costs should also be provided in the budget narrative for each project year outlined in Section C. For applications that include contracts for work conducted at collaborating institutions, applicants should submit an itemized budget spreadsheet for each contract for each project year, and the details of the contract costs should be included in the budget narrative. Applicants should use their institution's federal indirect cost rate and use the off-campus indirect cost rate where appropriate (see instructions under Section 9 Special Requirements). If less than 75 percent of total indirect costs are based on application of the off-campus rate, the applicant must provide a detailed justification.

h. *Appendix A*. In A*ppendix A,* the applicant may include any figures, charts, or tables that supplement the research text, and letters of agreement from all partners (e.g., schools) and consultants. Letters of agreement should include enough information to make it clear that the author of the letter understands the nature of the commitment of time, space, and resources to the research project that will be required if the application is funded. The appendix is limited to 15 pages.

i. *Appendix B* (optional). For proposals in which an intervention is proposed, applicants may include in *Appendix B* up to 10 pages of examples of curriculum material, computer screens, or further description of the intervention.

Please note that applicants selected for funding will be required to submit the following certifications and assurances before a grant is issued:

(1) SF 424B-Assurances-Non-Construction Programs
(2) ED-80-0013-Certification Regarding Lobbying, Debarment, Suspension and other Responsibility
(3) Matters; and Drug-Free Workplace Requirements
(4) ED 80-0014 (if applicable)-Lower Tier Certification
(5) SF-LLL (if applicable) - Disclosure of Lobbying Activities

13. APPLICATION PROCESSING

Applications must be received by **8:00 p.m. Eastern time** on the application receipt date listed in the heading of this request for applications. Upon receipt, each application will be reviewed for completeness and for responsiveness to this request for applications. Applications that do not

address specific requirements of this request will be returned to the applicants without further consideration.

14. PEER REVIEW PROCESS

Applications that are complete and responsive to this request will be evaluated for scientific and technical merit. Reviews will be conducted in accordance with the review criteria stated below by a panel of scientists who have substantive and methodological expertise appropriate to the program of research and request for applications.

Each application will be assigned to at least two primary reviewers who will complete written evaluations of the application, identifying strengths and weaknesses related to each of the review criteria. Primary reviewers will independently assign a score for each criterion, as well as an overall score, for each application they review. Based on the overall scores assigned by primary reviewers, an average overall score for each application will be calculated and a preliminary rank order of applications prepared before the full peer review panel convenes to complete the review of applications.

The full panel will consider only those applications deemed to have the highest merit, as reflected by the preliminary rank order, generally the top 30, and the most competitive proposals will be discussed and scored.

15. REVIEW CRITERIA FOR SCIENTIFIC MERIT

The goal of Institute-supported research is to contribute to the solution of education problems and to provide reliable information about the education practices that support learning and improve academic achievement and access to education for all students. Reviewers will be expected to assess the following aspects of an application in order to judge the likelihood that the proposed research will have a substantial impact on the pursuit of that goal. Information pertinent to each of these criteria is also described above in the section on Requirements of the Proposed Research and in the description of the research narrative, which appears in the section on Contents and Page Limits of Application.

Significance	Does the applicant make a compelling case for the potential contribution of the project to the solution of an education problem?
Research Plan	Does the applicant present (a) a strong rationale for the project; (b) clear hypotheses or research questions; (c) clear descriptions of and strong rationales for the sample, the measures, data collection procedures, and research design; and (d) a detailed and well-justified data analysis plan? Does the research plan meet the requirements described in the section on the Requirements of the Proposed Research and in the description of the research narrative in the section on Contents and Page Limits? Is the research plan appropriate for answering the research questions or testing the proposed hypotheses?
Personnel	Does the description of the personnel make it apparent that the principal investigator, project director, and other key personnel possess the training and

experience and will commit sufficient time to competently implement the proposed research?

Resources — Does the applicant have the facilities, equipment, supplies, and other resources required to support the proposed activities? Do the commitments of each partner show support for the implementation and success of the project?

16. RECEIPT AND REVIEW SCHEDULE

Letter of Intent Receipt Date: November 20, 2003
Application Receipt Date: January 8, 2004, 8:00 p.m. Eastern time
Earliest Anticipated Start Date: June 1, 2004

17. AWARD DECISIONS

The following will be considered in making award decisions:

Scientific merit as determined by the peer review
Responsiveness to the requirements of this request
Performance and use of funds under a previous Federal award
Contribution to the overall program of research described in this request
Availability of funds

18. INQUIRIES MAY BE SENT TO:

Dr. Elizabeth Albro
Institute of Education Sciences
555 New Jersey Avenue, NW
Washington, DC 20208

Email: Elizabeth.Albro@ed.gov
Telephone: (202) 219-2148

19. PROGRAM AUTHORITY

20 U.S.C. 9501 et seq., the "Education Sciences Reform Act of 2002," Title I of Public Law 107-279, November 5, 2002. This program is not subject to the intergovernmental review requirements of Executive Order 12372.

20. APPLICABLE REGULATIONS

The Education Department General Administrative Regulations (EDGAR) in 34 CFR parts 74, 77, 80, 81, 82, 85, 86 (part 86 applies only to Institutions of Higher Education), 97, 98, and 99. In addition 34 CFR part 75 is applicable, except for the provisions in 34 CFR 75.100, 75.101(b), 75.102, 75.103, 75.105, 75.109(a), 75.200, 75.201, 75.209, 75.210, 75.211, 75.217, 75.219, 75.220, and 75.230.

21. REFERENCES

Carver, S. M., & Klahr, D. (Eds.). (2001). *Cognition and instruction: Twenty-five years of progress*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.